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ABSTRACT

The purpose of this study was to: (1) determine to what extent instructional technology was being utilized; (2) determine what was the descriptive profile of teacher use; and (3) to examine the environmental and personal factors that effected the decision to use instructional technology. The survey data was analyzed by cross tabulations and regression analysis to look for correlation or predictive factors between variables. Results indicate that environmental factors such as access, the number of Internet connected computers, and the level of support and pressure are related to the focus and number of minutes of instructional technology use. Personal factors such as skill self-rating, and teacher beliefs were related to the focus, frequency, and number of minutes of instructional technology use. Teacher demographic characteristics of subject area taught, and years of computer experience were also indicated to be related to the number of minutes of instructional technology use. (Contains 24 references and 2 tables.) (Author/AEF)

Environmental and Personal Factors Effecting K–12 Teacher Utilization of Technology

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INTRODUCTION

The current level of money, interest, and time being expended on technology based instruction in schools makes it a significant component of the educational process. Despite it's potential and the wealth of available information, many schools are still experiencing difficulty in implementing the use of technology in the classroom beyond drill and practice. Much of the research shows that in spite of current technology capabilities, instructional technology is primarily used in traditional ways to sustain existing curricula (Office of Technology Assessment, 1995) rather than to make major changes to reform education. But this is not new. Historically, education has really changed very little over the years despite technology and other reform efforts. Wide-scale adoption of many of these reform efforts failed for some of the same reasons computer technology has been slow to gain acceptance in schools today. Lack of funds, poor quality or unreliable equipment, poor planning, limited vision, insufficient time, and inadequate teacher training can all play a part in teacher disappointment and resistance to new technology (Snider, 1992).

The purpose of this study was to examine the level of utilization of instructional technology and the factors that predict its use. More specifically: (1) determine to what extent instructional technology was being utilized in selected public schools in southwest Louisiana, and (2) to examine the environmental and personal factors that effected the decision to use instructional technology. Areas of research that may be useful in explaining the phenomenon of teachers adopting instructional technology are: andragogy or adult learning theory, change theory, diffusion of innovations, Concerns-Based Adoption Model, and staff development concepts.

METHODS AND PROCEDURES

This study sample included four parish school districts in Louisiana. [The subdivisions for local government in Louisiana are referred to as parishes rather than counties. There are 64 parishes in the

state and each parish functions as a school district, as well as two additional city districts located in metropolitan areas. Although the student enrollment in the 66 school districts ranges from as few 1,285 students to as many as 82,187, approximately one-half of the districts have less than 6,000 students.]

The participants were 308 classroom teachers employed in unit (K-12) schools within this region. Total sample included the faculties of ten (10) schools. This was a non-random sample. As Table I, Socioeconomic and Demographic Information illustrates, there are variations in the demographic and socioeconomic characteristics of the sample school districts' host parish.

Table I. SOCIOECONOMIC AND DEMOGRAPHIC INFORMATION

Parish District	Parish Population [1]	% High School Graduates [2]	% College Graduates [2]	Median Income [3]
District A	24,218	57.1%	6.7%	$23,365
District B	180,607	70.3%	14.7%	$31,618
District C	8,969	61.1%	7.9%	$30,649
District D	31,423	59.9%	8.0%	$24,269
State Data	4,372,035	68.3%	16.1%	$27,265

U. S. Census Bureau Data [1]1999, [2]1990, [3]1995

District A has approximately 4,464 students, which rank it 41st statewide in student population. District D has approximately 6,000 students and ranks 32nd out of the 66 districts in student enrollment. District C would rank 61st in student enrollment with slightly more than 2,000 students. Districts A, C, and D are considered rural and are comprised of communities, relatively small towns and cities. In contrast, District B is the 5th largest district in the state with over 33,000 students. School district level characteristics are cited in Table II School District Sample Information.

It is important to study rural schools since 55% of the Louisiana public schools are located in either rural areas or small towns (Tompkins & Deloney, 1994). About one-half of the nation's public schools, and approximately 40% of public school students are in rural areas and small towns. That is,

of the approximately 80,700 public schools nationwide, 24% are in central cities, 27% are in urban fringe areas, and 49% are in rural areas. This also means that of the approximately 2.56 million public school teachers, about 41% are in rural and small town schools (NEA, 1998). Although this sample can not be considered representative of all public teachers, it does provide a snapshot of teachers in small rural schools.

Data collection utilized an anonymous survey developed to gather information in the areas of (1) Teacher Demographics, (2) Current Instructional Technology Use, (3) Environmental Factors, and (4) Personal Factors. The survey questions were developed based upon the literature in the field of

Table II. SCHOOL DISTRICT SAMPLE INFORMATION

School District	Total Number Schools/ Total Number Faculty	Number of Unit Schools/Number of Unit School Faculty*	% Poverty Level	% Minority	% Special Education
District A	11/ 335	3/80	31.2%	23.2%	9.6%
District B	57/2370	2/72	19.1%	23.8%	12.9%
District C	7/174	3/86	16.2%	6.2%	12.6%
District D	14/431	2/70	25.0%	19.5%	15.5%
Total 4	89/3310	10/308	--	--	--
State Data	1483/48,772	68/2,111	23.6% (58% F/R Lunch)	50.2%	--

Louisiana State Department of Education Progress Profile Reports 1998-99;*Principal Interview Data

educational technology and patterned after questions seeking data on similar criteria from other small studies and large-scale investigations. Other questions were developed based on research and theoretical constructs such as Roger's (1995) Perceived Attributes, Hall and Hord (1987) Stages of

Concern of the Concerns-Based Adoption Model, and the work of Michael Fullan (1991, 1996). The survey was designed to gather additional data in the area of teacher perceptions regarding pressure to adopt and utilize instructional technology.

Data was compiled in frequency counts and regression analysis by criteria being studied. Subgroups such as grade level, subject area, level of professional development participation, years of experience, etc. were reviewed in aggregate. The study design was a between-subjects correlational study. The independent variables were the specified personal and environmental factors. The dependent variable was the utilization of instructional technology. Data analysis included frequency tables, cross tabulation analysis, and analysis of variance (ANOVA) or regression analysis to look for differences between groups and correlation or predictive factors between variables.

Administrators from the selected schools participated in a brief interview prior to the distribution of the survey to the faculty. The questions developed for the Principal Interview were also grounded in the review of literature and aligned with the teacher survey. The Principal Interview questionnaire was utilized to clarify and validate teacher responses. A response was obtained from an administrator at each of the ten schools for the Principal Interview, or 100% response rate. The return rate for the teacher survey was 150 out of 308 or a 49% response rate.

SUMMARY OF FINDINGS

The teacher response sample included teachers across all grade levels (K-12), subject areas, years of teaching experience (one to more than twenty-six), degree levels (less than a bachelors to Education Specialists), and computer experience (less than one year to more than five years). It may be important to note that approximately 36% of the respondents indicated that they taught grades K-5, 15.3% middle school grades 6-8, 34.1% high school, and over 14% were multi-level special education or other. Over one-fourth (25.7%) of the teachers reported teaching in the core content subject areas of math, science, social studies, or English language arts, and 31.5% indicated elementary education as

their content area. Also over one-half (52%) of the sample indicated more than 15 years of teaching experience, and 34% had more than 20 years experience. It was also reported that 80% did have a home computer, and 69.9% of these were Internet connected.

Teacher responses were grouped for further analysis and comparison. Regarding the extent of technology use as addressed in the first research question, there were no real differences found in the average number of minutes engaged in Internet activities between elementary and core content teachers. There were slight differences in the average number of minutes students were engaged in technology based instruction, with more elementary teachers spending slightly more time per week. This was consistent with fewer elementary teachers reporting the frequency of use as rarely or never.

Cross tabulation analysis also indicated some differences between teachers with varying years of computer experience. Almost one-half (42%) of teachers indicating two years or less of computer experience, reported the weekly use of instructional technology for their average student was zero minutes, in contrast to only 17.5% of teachers indicating three or more years of experience with computers reporting at the same level of use. This is consistent with the responses for frequency of use with 52.2% of the less experienced teachers choosing the categories of rarely or never, compared to 27.1% of the more experienced teachers. There was a significant but weak relationship indicated through regression analysis between years of computer experience ($t=2.465$, $df=144$, $p<.05$) and the average number of minutes per week a student spent engaged in instructional technology. Hadley and Sheingold (1993) reported that most technology proficient teachers had five to nine years of computer experience.

Regarding the descriptive profile of teacher use, cross case analysis revealed classroom tasks, such as programming and graphics, although not very prevalent, were more predominant at the upper high school level and in the area of mathematics. The classroom task of utilizing instructional

software was most predominant at the elementary level, followed by educational games. The primary focus of technology based activities was drill and practice and whole-class instruction for the elementary educators. Other related studies resulted in similar findings. These include Ertmer, et al. (1999), who found in a small study of lower elementary teachers, the majority of use was for instructional games or drill and practice activities, and Cummings (1998), who reported that about 50% of the upper elementary teachers surveyed used technology for drill and practice.

There was a significant but weak relationship indicated through regression analysis between subject area taught and the average number of minutes per week a student spent engaged in instructional technology. English Language Arts and Reading teachers most often reported word processing tasks (57%) as the best description of instructional technology use in their classroom. Science teachers reported whole-class instruction (63%) as the primary focus, as did English Language Arts and Reading teachers (43%), whereas Social Studies teachers reported student-directed learning (44%). Most other subject areas were spread across the categories, with the exception of computer literacy skills, which was low or nonexistent. Core content teachers seemed to prefer whole-class instruction (43.1%) where elementary teachers cited drill and practice (38.3%) as the primary focus of instruction. Internet based activities appear to increase with grade level, and educational game activities seem to decrease.

Some differences were noted between teachers with a Bachelors degree or less, and teachers with advanced degrees. Many teachers with advanced degrees (38.9%), indicated whole-class instruction as the primary focus of instruction, compared to the teachers with a Bachelors degree or less (26.9%). Teachers with advanced degrees also reported less use of drill and practice, and student-directed activities than did their counterparts.

The study results regarding how technology is used in the curriculum were further validated by principal interview responses. The first principal interview question asked: Do you think technology should (a) be an optional supplement, (b) support and enrich, or (c) drive and shape the curriculum? Nine out of ten administrators chose "(b) to support and enrich the curriculum" and one administrator responding "(c) to drive and shape the curriculum". These responses are also aligned with the teacher responses. A majority of teachers (84.4%) also indicated that the role of technology in the curriculum was (b) to support, enrich and enhance.

Environmental Factor Summary

Study results indicated that the teachers did have ample access to technology. Less than 5% of the respondents indicated that they did not have at least one computer in their classroom. Over 80% indicated that there was at least one Internet connected computer in their classroom. Over one-third of the teachers surveyed indicated the classroom as their primary location for access, with about one-fourth citing equal access between the classroom and a computer lab. Analysis indicated that access in terms of the number of computers, and the number of Internet connected computers was positively related to the number of minutes of technology based instruction.

Almost one-half of the respondents indicated spending less than six hours in technology related professional development activities in the last two years. Approximately one-third reported they had never completed a technology related college course, and one-third had completed at least one. Slightly over one-half of the respondents indicated frequency of opportunities to participate in school or district sponsored technology training to be regularly once or twice a semester, or more often. There were no statistically significant relationships indicated between professional development and use in this study.

More than one-half of the teachers indicated that teachers in their school or district had

opportunities to provide input in decision-making and network to share ideas. Teachers citing that there were opportunities for input and networking also indicated a greater level of technology use in terms of average minutes per week. There were no statistically significant relationships indicated between perceptions of input and networking to technology use.

Approximately one-half of the respondents felt they had adequate or better support, and one-third indicated support was available, but more would be helpful. Teachers citing higher levels of support also indicated greater student engagement in instructional technology in terms of average minutes per week and frequency of use. Analysis indicated that the level of support was positively related to the focus of technology use. Over one-half of the teachers receive the majority of support from other teachers or school level personnel.

Slightly more than one-fourth of the respondents reported feeling pressured to utilize technology, and most of these cited administrators or principals as the greatest source of pressure. Analysis indicated that pressure may be related to the focus of technology use.

Personal Factor Summary

Almost all teachers surveyed rated themselves in the mid range of technological ability. Less than 2% of the respondents described themselves as a 'nonuser'. Nearly one-half felt that they could use specific programs and help students with technology, nearly one-fourth felt that they could integrate technology into the curriculum, and less than 20% indicated that they were beginners with limited experience. The self-reported ability was found to be consistent with the reported number of minutes of technology use—the higher the rating, the higher the level of reported use.

More teachers cited limited access as the primary barrier to technology integration than any other area. In light of responses regarding the number of available computers and setting, and the reported levels of use, access barriers may be in terms of a desire for an increase in the number of

computers per classroom for lower student to computer ratios, or other issues not addressed in this study. Limited time was the second most frequently cited barrier.

The indicated Stage of Concern for responding teachers as a group was not consistent with other indicators of technology use. The relatively low Stage 3 management and Stage 5 collaboration concerns do not support that most teachers have adopted or accepted instructional technology. The Stages of Concern most frequently cited (informational and personal) would typically be associated with novices, or teachers just beginning to use technology. More data would need to be collected on individual teachers to develop a more accurate profile with regard to the Stages of Concern. Although regression analysis did indicate a weak, but significant relationship between teacher concern and the focus of use.

In general, teachers in this study seemed to have a relatively positive perception of technology as indicated by survey responses regarding beliefs. Analysis indicated there was a possible relationship found between specific belief statements and the perceived attributes of observability and relative advantage, and the focus and description of technology use.

SUMMARY

More personal factors, such as statements relating to beliefs, concerns, and the perceived attribute of observability were found to be related to the focus of technology use, as were the environmental factors of the perception of support and pressure. Personal factors such as statements pertaining to beliefs, and to the perceived attribute of relative advantage were found to be related to the frequency of use. A weak relationship was noted between the environmental factor of the number of Internet connected computers in the classroom and the average number of minutes that students spent engaged in Internet based activities per week. A relationship was also indicated between the personal factor of teacher self-rating of their technological ability and the average number of minutes per week

that students were engaged in technology based activities, as was the environmental factor of the number of computers in the classroom.

Findings from the frequency counts, cross tabulation analysis and statistical tests of regression analysis indicated significant relationships between specific environmental and personal factors and the use of instructional technology. Some more anticipated predictors for frequency in minutes, were the number of computers in classrooms; and for self-reported frequency level, teachers' belief that computer knowledge would help teachers be better instructors and technology offered advantages over other instructional strategies. Although there were no significant findings relating to instructional technology tasks, teacher beliefs that it can improve student performance and teacher perceptions of support and pressure were related to the focus of instruction.

This study did not address how teachers may adapt technology use in the classroom nor its effectiveness as an instructional strategy. This study also did not address the effects of teacher personal interest, teacher workload, prior teacher knowledge, teacher pedagogy, or differences in leadership. This study did provide a snapshot of the various aspects of technology utilization for teachers in rural K-12 unit schools. Thus, the results of this study may have limited generalizability to other school systems or faculty.

Although this was a small study involving ten public schools in four districts, many prior studies were also relatively small. Marcinkiewicz's 1993 study included 170 participants from four schools. Oliver's 1994 Australian study of beginning teachers had 122 respondents. Chiero (1999) utilized a 48-item survey to gather data from 36 K-12 teachers enrolled in one of three college courses. Cummings (1998) surveyed 30 K-5 teachers with a 60-item survey. The qualitative studies involved smaller samples of seven (Ertmer, 1999), and ten (Stuhlmann, 1998). Much of the information from frequency counts and cross tabulations was consistent with prior studies. Demographics such as years

of teaching experience was found to be significant in prior studies (Hadley & Sheingold, 1993; Maney, 1994; Becker, 1994; Harris & Grandgenett, 1999) as was years of computer experience, with the exception of Maney (1994). The results of this study also indicated that the years of computing experience and the subject area taught were related to the number of minutes of instructional technology use.

The only finding that may have been somewhat unexpected, was the relatively overall positive indicators toward instructional technology in beliefs, and a higher level of reported access and use. The study participants reported greater access to technology than many prior studies (Blankenship, 1998; Jaber, 1997; OTA, 1995). This increase in available technologies may be a result of increased state, federal, or local funding initiatives, or the natural expansion of technology in society. As demand increases and costs decrease, technology access and use is becoming more prevalent. Technology is changing so rapidly, it is difficult for research to stay abreast of the current trends.

Other environmental issues, such as support and pressure, were found to be related to use. These concepts were also discussed by prior researchers (Carter, 1998; Chiero,1997; Dirksen & Tharp, 2000; Dwyer, Ringstaff, & Sandholtz,1991; Ely,1990), as potential predictors or factors influencing technology use. Teacher self-rating of technology ability was also found to be related to technology use in this study, and was a strong predictor found in prior studies conducted by Becker (1999) and Chiero (1997). As students from this 'technological' generation enter the teaching profession, it could be expected that instructional technology use will increase.

The results indicate that most teachers are accepting technology in the classroom and want to learn more about it, as evidenced by the 85.7% affirmative response to intentions for future use. The study results indicate how environmental factors such as access, the number of Internet connected computers, and the level of support and pressure are related to the focus and number of minutes of

instructional technology use. The study results also indicated that personal factors such as the self-rating of technological skill and teacher beliefs were related to the focus, frequency, and number of minutes of instructional technology use. Teacher demographic characteristics of subject area taught and years of computer experience were also indicated to be related to the number of minutes of instructional technology use.

Results of this study indicated that training opportunities were available, at least at the district level for the majority of teachers. The finding of the relationship between computer experience and use further suggests the potential impact of quality training and inservice activities. The absence of relationships between other demographic variables indicates a limited impact on use, and should be less of a concern for technology coordinators and staff developers.

The study results also indicate that teachers' beliefs regarding the value of technology is related to the level of use. This finding suggests that for more effective inservices, technology leaders must make the crucial link between the technology and the desired educational outcome. Teachers need to see that utilizing the tools of technology will produce positive student gains before they will risk adopting its use. The costs of utilizing educational technology in terms of dollars, time, and sheer human effort are much too high, to not try to accomplish it as efficiently and effectively as possible. Study results indicate access alone, is not enough to ensure utilization of technology in terms of frequency (time) and variety of focus or tasks should be systematically encouraged.

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